User Manual

This User Manual is the primary guide to the handling and basic techniques of epoxy use. It describes how to dispense, mix and modify WEST SYSTEM epoxy for the basic coating, filling and bonding techniques used in most repair and construction procedures.

These procedures are described in detail in WEST SYSTEM instructional publications and videos. For complete descriptions of all WEST SYSTEM products, including selection and coverage guides, go to the Product Guide.

- To help you identify and prevent potential problems associated with using epoxy, go to the Problem Solver.
- For complete information on the hazards associated with epoxy and the precautions you can take to avoid them, go to Health & Safety.
- To see how these techniques have been put to use in a wide range of repair and construction applications go to the Projects pages.

HANDLING EPOXY

Epoxy chemistry

Epoxy's cure stages

Mixing epoxy resin and hardener begins a chemical reaction that transforms the combined liquid ingredients to a solid. The time it takes for this transformation is the cure time. As it cures, the epoxy passes from the liquid state, through a gel state, before it reaches a solid state (Figure 1).

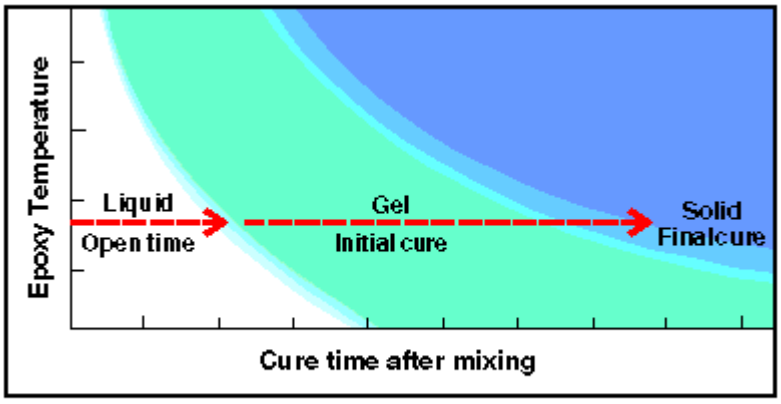


Figure 1

As it cures, mixed epxoy pass from a liquid state, through a gel state, to a solid state.

1. Liquid-Open time Open time (also working time or wet lay-up time) is the portion of the cure time, after mixing, that the resin/hardener mixture remains a liquid and is workable and suitable for application. All assembly and clamping should take place during the open time to assure a dependable bond.

2. Gel-Initial cure The mixture passes into an initial cure phase (also called the green stage) when it begins to gel or "kick-off." The epoxy is no longer workable and will no longer feel tacky. During this do not disturb stage it progresses from a soft gel consistency to the firmness of hard rubber. You will be able to dent it

with your thumbnail.

Because the mixture is only partially cured, a new application of epoxy will still chemically link with it, so the surface may still be bonded to or recoated without special preparation. However, this ability diminishes as the mixture approaches final cure.
3. Solid-Final cure The epoxy mixture has cured to a solid state and can be dry sanded and shaped. You should not be able to dent it with your thumbnail. At this point the epoxy has reached about 90% of its ultimate strength, so clamps can be removed. It will continue to cure over the next several days at room temperature.

A new application of epoxy will no longer chemically link to it, so the surface of the epoxy *must be properly prepared and sanded* before recoating to achieve a good mechanical, secondary bond. See Surface Preparation

Understanding cure time

Open time and cure time govern much of the activity of building and repairing with epoxy. Open time dictates the time available for mixing, application, smoothing, shaping, assembly and clamping. Cure time dictates how long you must wait before removing clamps, or before you can sand or go on to the next step in the project. Two factors determine an epoxy mixture's open time and overall cure time-*hardener cure speed* and *epoxy temperature*.

Hardener speed

Each hardener has an ideal temperature cure range. At any given temperature, each resin/hardener combination will go through the same cure stages, but at different rates. Select the hardener that gives you adequate working time for the job you are doing at the temperature and conditions you are working under. The product guide and container labels describe hardener pot lives and cure times.

Pot life is a term used to compare the cure speeds of different hardeners. It is the amount of time a specific mass of mixed resin and hardener remains a liquid at a specific temperature. (A 100g-mass mixture in a standard container, at 72° F). Because pot life is a measure of the cure speed of a specific contained mass (volume) of epoxy rather than a thin film, a hardener's pot life is much shorter than its open time.

Epoxy temperature

The warmer the temperature of curing epoxy, the faster it cures (Figure 1). The temperature of curing epoxy is determined by the ambient temperature plus the exothermic heat generated by its cure.

Ambient temperature is the temperature of the air or material in contact with the epoxy. Air temperature is most often the ambient temperature unless the epoxy is applied to a surface with a different temperature. Generally, epoxy cures faster when the air temperature is warmer.

Exothermic heat is produced by the chemical reaction that cures epoxy. The amount of heat produced depends on the thickness or exposed surface area of mixed epoxy. In a thicker mass, more heat is retained, causing a faster reaction

and more heat. The mixing container's shape and the mixed quantity have a great affect on this exothermic reaction. A contained mass of curing epoxy (8 fl. oz. or more) in a plastic mixing cup can quickly generate enough heat to melt the cup and burn your skin. However, if the same quantity is spread into a thin layer, exothermic heat is dissipated, and the epoxy's cure time is determined by the ambient temperature. The thinner the layer of curing epoxy, the less it is affected by exothermic heat, and the slower it cures.

Controlling cure time

In warm conditions use a slower hardener, if possible. Mix smaller batches that can be used up quickly, or pour the epoxy mixture into a container with greater surface area (a roller pan, for example), thereby allowing exothermic heat to dissipate and extending open time. The sooner the mixture is transferred or applied (after thorough mixing), the more of the mixture's useful open time will be available for coating, lay-up or assembly.

In cool conditions use a faster hardener, or use supplemental heat to raise the epoxy temperature above the hardener's minimum recommended application temperature. Use a hot air gun, heat lamp or other heat source to warm the resin and hardener before mixing or after the epoxy is applied. At room temperature, supplemental heat is useful when a quicker cure is desired.

For detailed information on working with epoxy at low temperatures, refer to 002-915 Cold Temperature Bonding and Coating with Epoxy.

CAUTION! Heating epoxy that has not gelled will lower its viscosity, allowing the epoxy to run or sag more easily on vertical surfaces. In addition, heating epoxy applied to a porous substrate (softwood or low-density core material) may cause the substrate to "out-gas" and form bubbles in the epoxy coating. To avoid out-gassing, wait until the epoxy coating has gelled before warming it. Never heat mixed epoxy in a liquid state over 120°F (49°C).

Regardless of what steps are taken to control the cure time, thorough planning of the application and assembly will allow you to make maximum use of epoxy's open time and cure time.

Dispensing and mixing

Careful measuring of epoxy resin and hardener and thorough mixing are essential for a proper cure. Whether the resin/hardener mixture is applied as a coating or modified with fillers or additives, observing the following procedures will assure a controlled and thorough chemical transition to a high-strength epoxy solid.

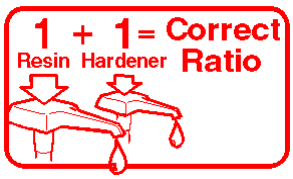
Dispensing

Dispense the proper proportions of resin and hardener into a clean plastic, metal or wax-free paper container (Figure 2). Don't use glass or foam containers because of the potential danger from exothermic heat build-up.

Figure 2 Dispense the proper proportion of resin and hardener.

DO NOT attempt to adjust the epoxy cure time by altering the mix ratio. An accurate ratio is essential for a proper cure and full development of physical properties.

- **Dispensing with Mini pumps** - Most problems related to curing of the epoxy can be traced to the wrong ratio of resin and hardener. To simplify metering, we recommend using calibrated WEST SYSTEM Mini Pumps to dispense the resin and hardener. Mini Pumps are calibrated to deliver the proper working ratio of resin to hardener.



Pump one full pump stroke of resin for each one full pump stroke of hardener. Depress each pump head fully and allow the head to come completely back to the top before beginning the next stroke. Partial strokes will give the wrong ratio. Read the pump instructions before using pumps.

Before you use the first mixture on a project, verify the proper ratio according to the instructions that come with the pumps. Re-check the ratio anytime you experience problems with curing.

- **Dispensing without Mini Pumps** (Weight/volume measure) - To measure 105 Resin and 205 or 206 Hardener by weight or volume, combine five parts resin with one part hardener. To measure 105 Resin and 207 or 209 Hardener by volume, combine three parts resin with one part hardener (by weight, 3.5 parts resin-1 part hardener).

First time users

If this is the first time you have used WEST SYSTEM epoxy, begin with a small test batch to get the feel for the mixing and curing process, before applying the mixture to your project. This will demonstrate the hardener' s open time for the temperature you are working in and assure you that the resin/hardener ratio is metered properly. Mix small batches until you are confident of the mixture' s handling characteristics.

Mixing

Stir the two ingredients together thoroughly-at least 1 minute-longer in cooler temperatures (Figure 3). To assure thorough mixing, scrape the sides and bottom of the pot as you mix. Use the flat end of the mixing stick to reach the inside corner of the pot. If you are using a power mixer, occasionally scrape the sides and corners of the mixing pot while mixing.

Figure 3 Stir resin and hardener together thoroughly - at least 1 minure, longer in cooler tem peratures.

If you are going to be using the mixture for coating, quickly pour it into a roller pan to extend the open time.

WARNING! Curing epoxy generates heat. When contained, a large mass of curing epoxy has a very short pot life, and can generate enough heat to melt plastic and foam, burn your skin and ignite combustible materials. For this reason do not use foam or glass mixing containers. If a pot of mixed epoxy begins to exotherm (heat up), quickly move it outdoors. Avoid breathing the fumes. Do not dispose of the mixture until the reaction is complete and has cooled. Do not fill or cast layers of epoxy thicker than 1/2"-thinner if enclosed by foam or other insulating material. Do not pour into confined spaces.

Adding fillers and additives

Fillers

Throughout this and other WEST SYSTEM manuals, we refer to *epoxy, neat epoxy or resin/hardener mixture*, meaning mixed resin and hardener **without** fillers added; and *thickened mixture or thickened epoxy*, meaning mixed resin and hardener **with** fillers added. Fillers are used to thicken epoxy for specific applications such as bonding or fairing.

After selecting an appropriate filler for your job *(see Filler Selection Guide)*, use it to thicken the epoxy mixture to the desired consistency. The thickness of a mixture required for a particular job is controlled by the amount of filler added. There is no strict formula or measuring involved-use your eye to judge what consistency will work best. Figure 5 gives you a general guide to the differences between neat (unthickened) epoxy and the three consistencies referred to in this manual.

Always add fillers in a two-step process:

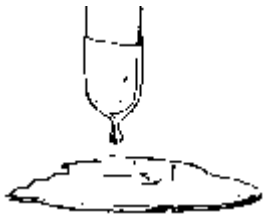
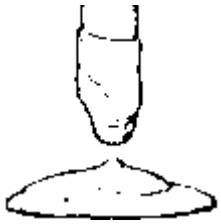
1. Mix the desired quantity of resin and hardener thoroughly before adding fillers. Begin with a small batch-allow room for the filler.
2. Blend in small handfuls or scoops of the appropriate filler until the desired consistency is reached (Figure 4).

Figure 4

Stir in small handfuls of filler until the desired consistancy is reached.

For maximum strength, add only enough filler to completely bridge gaps between surface without sagging or running out of the joint or gap. A small amount should squeeze out of joints when clamped. For thick mixtures, don' t fill the mixing cup more than 1/3 full of epoxy before adding filler. When making fairing compounds, stir in as much 407 or 410 as you can blend in smoothly-for easy sanding, the thicker the better. Be sure all of the filler is thoroughly blended before the mixture is applied. Spread the mixture into a thinner layer, either around the inside of the mixing cup or onto a flat non-porous surface or palette, to extend its working life.

Epoxy can be thickened to the ideal consistency needed for a particular job. The procedures in this manual refer to four common consistencies: syrup, catsup, mayonnaise and peanut butter.

	**SYRUP**	
	CONSISTENCY:	Unthickened mixture
	CHARACTERISTICS:	Drips off vertical surfaces
	USES:	Coating; wetting-out before bonding; applying fiberglass, graphite and other fabrics
	**CATSUP**	
	CONSISTENCY:	Slightly thickened
	CHARACTERISTICS:	Sags down vertical surfaces
	USES:	Laminating/bonding flat panels with large surface areas, injecting with a syringe
	MAYONNAISE	
	CONSISTENCY:	Moderately thickened
	CHARACTERISTICS:	Clings to vertical surfaces; peaks fall over
	USES:	General bonding, filleting, hardware bonding
	PEANUT BUTTER	

	CONSISTENCY:	Maximum thickness
	CHARACTERISTICS:	Clings to vertical surfaces; peaks stand up
	USES:	Gap filling, filleting, fairing, bonding uneven surfaces

Additives

Additives are used to give epoxy additional physical properties when used as a coating. Although additives are blended with mixed epoxy in the same two-step process as fillers, they are not designed to thicken the epoxy. *(Refer to Additive descriptions)* Follow the mixing instructions on the individual additive containers.

Clean up

Contain large spills with sand, clay or other inert absorbent material. Use a scraper to contain small spills and collect as much material as possible. Follow up with absorbent towels. Uncontaminated resin or hardener may be reclaimed for use.

DO NOT use sawdust or other fine cellulose materials to absorb hardeners. DO NOT dispose of hardener in trash containing sawdust or other fine cellulose materials-spontaneous combustion can occur.

Clean resin or mixed epoxy residue with lacquer thinner, acetone or alcohol. Follow all safety warnings on solvent containers. Clean hardener residue with warm soapy water.

Dispose of resin, hardener and empty containers safely. Puncture a corner of the can and drain residue into the appropriate new container of resin or hardener.

DO NOT dispose of resin or hardener in a liquid state. Waste resin and hardener can be mixed and cured (in small quantities) to a non-hazardous inert solid.

CAUTION! Large pots of curing epoxy can get hot enough to ignite surrounding combustible materials and give off hazardous fumes. Place pots of mixed epoxy in a safe and ventilated area, away from workers and combustible materials. Dispose of the solid mass only if cure is complete and the mass has cooled. Follow federal, state or local disposal regulations.

Thinning Epoxy

There are epoxy-based products specifically designed to penetrate and reinforce rotted wood. These products, basically an epoxy thinned with solvents, do a good job of penetrating wood. But the solvents compromise the strength and moisture barrier properties of the epoxy. WEST SYSTEM epoxy can be thinned with solvents for greater penetration, but not without the same

compromises in strength and moisture resistance. Acetone, toluene or MEK have been used to thin WEST SYSTEM epoxy and duplicate these penetrating epoxies with about the same effectiveness. If you chose to thin the epoxy, keep in mind that the strength and moisture protection of the epoxy are lost in proportion to the amount of solvent added.

There is a better solution to get good penetration without losing strength or moisture resistance. We recommend moderate heating of the repair area and the epoxy with a heat gun or heat lamp. The epoxy will have a lower viscosity and penetrate more deeply when it is warmed and contacts the warmed wood cavities and pores. Although the working life of the epoxy will be considerable shortened, slower hardeners (206, 207, 209) will have a longer working life and should penetrate more than 205 Hardener before they begin to gel. When the epoxy cures it will retain all of its strength and effectiveness as a moisture barrier, which we feel more than offsets any advantages gained by adding solvents to the epoxy.

Removing Epoxy

Removing uncured or non-curing epoxy. Uncured epoxy is removed as you would spilled resin. Scrape as much material as you can from the surface using a stiff metal or plastic scraper-warm the epoxy to lower its viscosity. Clean the residue with lacquer thinner, acetone, or alcohol. Follow safety warnings on solvents, and provide adequate ventilation. After recoating wood surfaces with epoxy, it' s a good idea to brush the wet epoxy (in the direction of the grain) with a wire brush to improve adhesion. Allow solvents to dry before recoating.

Removing fiberglass cloth applied with epoxy.

Use a heat gun to heat and soften the epoxy. Start in a small area a near a corner or edge. Apply heat until you can slip a putty knife or chisel under the cloth (about 200°F). Grab the edge with a pair of pliers and pull up on the cloth while heating just ahead of the separation. On large areas, use a utility knife to score the glass and remove in narrower strips. Resulting surface texture may be coated or remaining epoxy may be removed as follows.

Removing cured epoxy coating.

Use a heat gun to soften the epoxy (200°F). Heat a small area and use a paint or cabinet scraper to remove the bulk of the coating. Sand the surface to remove the remaining material. Provide ventilation when heating epoxy.

BASIC TECHNIQUES

The following basic techniques are common to most repair or building projects, regardless of the type of structure or material you are working with.

Surface preparation

Whether you are bonding, fairing or applying fabrics, the success of the application depends not only on the strength of the epoxy, but also on how well the epoxy adheres to the surface to which it is being applied. Unless you are bonding to partially cured epoxy, the strength of the bond relies on the epoxy' s

ability to mechanically "key" into the surface. That is why the following three steps of surface preparation are a critical part of any secondary bonding operation.

For good adhesion, bonding surfaces should be:

1. Clean Bonding surfaces must be free of any contaminants such as grease, oil, wax or mold release. Clean contaminated surfaces with lacquer thinner, acetone or other appropriate solvent. Wipe the surface with paper towels before the solvent dries. Clean surfaces *before* sanding to avoid sanding the contaminant into the surface. Follow all safety precautions when working with solvents. *(Figure 6)*

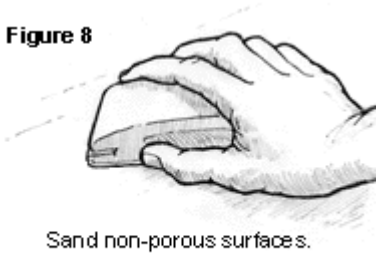
Figure 6 Clean the surface. Use a solvent, if necessary, to remove all contaminates.

2. Dry All bonding surfaces must be as dry as possible for good adhesion. If necessary, accelerate drying by warming the bonding surface with a hot air gun, hair dryer or heat lamp. Use fans to move the air in confined or enclosed spaces. Watch for condensation when working outdoors or whenever the temperature of the work environment changes. *(Figure 7)*

Figure 7 Dry the surface. Allow the surface to dry thoroughly or use heat or a fan to speed drying.

3. Sanded Sand smooth non-porous surfaces—thoroughly abrade the surface. 80-grit aluminum oxide paper will provide a good texture for the epoxy to "key" into. Be sure the surface to be bonded is solid. Remove any flaking, chalking, blistering, or old coating before sanding. Remove all dust after sanding. *(Figure 8)*

Figure 8



Sand non-porous surfaces. Provide a texture for epoxy to key into.

Special preparation for various materials

Cured epoxy-Amine blush can appear as a wax-like film on cured epoxy surfaces. It is a by-product of the curing process and may be more noticeable in cool, moist conditions. Amine blush can clog sandpaper and inhibit subsequent bonding, but it can easily be removed. It' s a good idea to assume it has formed on any cured epoxy surface.

To remove the blush, wash the surface with clean water (not solvent) and an abrasive pad, such as Scotch-brite(TM) 7447 General Purpose Hand Pads. Dry the surface with paper towels to remove the dissolved blush before it dries on the surface. Sand any remaining glossy areas with 80-grit sandpaper. Wet-sanding will also remove the amine blush. If a release fabric is applied over the surface of fresh epoxy, amine blush will be removed when the release fabric is peeled from the cured epoxy and no additional sanding is required.

Epoxy surfaces that have not fully cured may be bonded to or coated with epoxy without washing or sanding. Before applying coatings other than epoxy (paints, bottom paints, varnishes, gelcoats, etc.), allow epoxy surfaces to cure fully, then wash and sand.

Hardwoods-Sand with 80-grit paper.

Teak/oily woods-Wipe with acetone 15 minutes before coating. Solvent removes the oil at the surface and allows epoxy to penetrate. Be sure solvent has evaporated before coating.

Porous woods-No special preparation needed. If surface is burnished, possibly by dull planer or saw blades, sand with 80-grit paper to open pores. Remove dust.

Steel, lead-Remove contamination, sand or grind to bright metal, coat with epoxy then sand fresh epoxy into surface. Re-coat or bond after first coat gels.

Aluminum-Sand and prepare with 860 Aluminum Etch Kit.
Polyester (fiberglass)-Clean contamination with a silicone and wax remover such as DuPont Prep-Sol(TM) 3919S. Sand with 80-grit paper to a dull finish.

Plastic-Adhesion varies. If a plastic is impervious to solvents such as acetone, epoxy generally will not bond to it. Soft, flexible plastics such as polyethylene, polypropylene, nylon, Plexiglas and polycarbonate fall into this category.

Hard, rigid plastics such as PVC, ABS and styrene provide better adhesion with

good surface preparation and adequate bonding area. After sanding, flame oxidizing (by quickly passing propane torch over the surface without melting the plastic) can improve bonding in some plastics. It' s a good idea to conduct an adhesion test on a plastic that you are uncertain about.

Bonding (gluing)

This section refers to two types of bonding. Two-step bonding is the preferred method for most situations because it promotes maximum epoxy penetration into the bonding surface and prevents resin-starved joints. Single-step bonding can be used when joints have minimal loads and excess absorption into porous surfaces is not a problem. In both cases, epoxy bonds best when it is worked into the surface with a roller or brush.

Before mixing epoxy, check all parts to be bonded for proper fit and surface preparation, gather all the clamps and tools necessary for the operation, and cover any areas that need protection from spills.

Note: The term bonding as used here and other WEST SYSTEM literature refers to structural adhesion or gluing of components, not the electrical bonding

Two-step bonding

1. Wet-out bonding surfaces-Apply a neat resin/hardener mixture (without fillers) to the surfaces to be joined (Figure 9). Wet out small or tight areas with a disposable brush. Wet out larger areas with a foam roller or by spreading the resin/hardener mixture evenly over the surface with a plastic spreader. You may proceed with step two immediately or any time before the wet-out coat reaches the final cure stage.

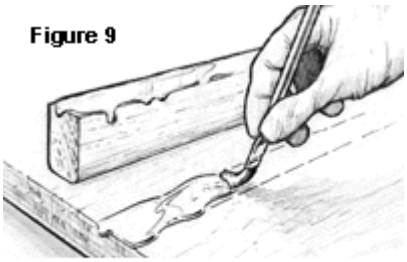


Figure 9

Apply resin/hardener mixture to the bonding surfaces.

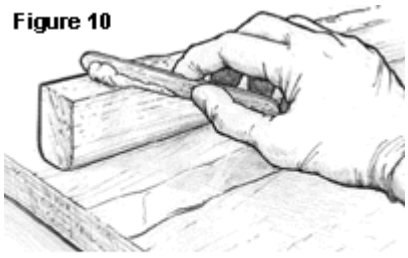


Figure 10

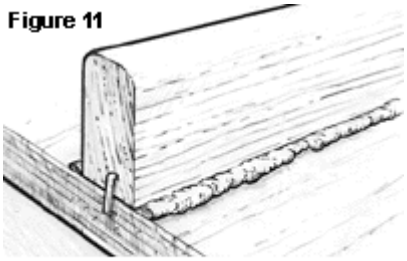
Apply thickened opoxy to one of the bonding surfaces.

2. Apply thickened epoxy to one bonding surface. Modify the resin/hardener mixture by stirring in the appropriate filler until it becomes thick enough to bridge any gaps between the mating surfaces and to prevent "resin-starved" joints. Apply enough of the mixture to one of the surfaces, so that a small amount will squeeze out when the surfaces are joined together with a force equivalent to a firm hand grip (Figure 10).

Thickened epoxy can be applied immediately over the wet-out surface or any time before the wet-out reaches its final cure. For most small bonding operations, add the filler to the resin/hardener mixture remaining in the batch that was used for the wet-out. Mix enough resin/hardener for both steps. Add the filler quickly after the surface is wet out and allow for a shorter working life of the mixture.

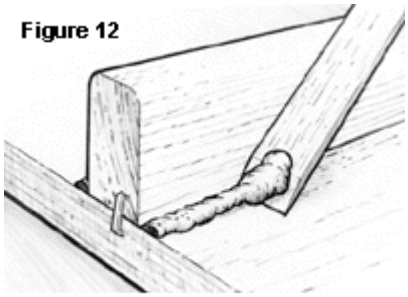
3. Clamp components. Attach clamps as necessary to hold the components in place. Use just enough clamping pressure to squeeze a small amount of the epoxy mixture from the joint, indicating that the epoxy is making good contact with both mating surfaces (Figure 11). Avoid using too much clamping pressure, which can squeeze all of the epoxy mixture out of the joint.

Figure 11



Clamp components in place before the epoxy gels.

Figure 12



Remove or shape excess epoxy that squeezes out of the joint.

4. Remove or shape excess adhesive that squeezes out of the joint as soon as the joint is secured with clamps. A wooden mixing stick with one end sanded to a chisel edge is an ideal tool for removing the excess (Figure 12).

Single-step bonding

Single-step bonding is applying the thickened epoxy directly to both bonding surfaces without first wetting out the surfaces with neat resin/hardener. We recommend that you thicken the epoxy no more than is necessary to bridge gaps in the joint (the thinner the mixture, the more it can penetrate the surface) and that you do not use this method for highly-loaded joints or for bonding end grain or other porous surfaces.

Laminating

The term "laminating" refers to the process of bonding numbers of relatively thin layers, like plywood, veneers, fabrics or core material to create a composite. A composite may be any number of layers of the same material or combinations of different materials. Methods of epoxy application and clamping will differ depending on what you are laminating.

Because of large surface areas and limitations of wet lay-up time, roller application is the most common method for applying epoxy. A faster method for large surfaces is to simply pour the resin/hardener mixture onto the middle of the panel and spread the mixture evenly over the surface with a plastic spreader. Apply thickened mixtures with an 809 Notched Spreader.

Using staples or screws is the most common method of clamping when you laminate a solid material to a solid substrate. An even distribution of weights will work when you are laminating a solid material to a base that will not hold staples or screws, such as a foam or honeycomb core material.

Vacuum bagging is the ideal clamping method for laminating a wide range of materials. Through the use of a vacuum pump and plastic sheeting, the atmosphere is used to apply perfectly even clamping pressure over all areas of a panel regardless of the size, shape or number of layers.

NOTES:

Primary/Secondary Bonding

Primary bonding relies on the chemical linking of adhesive layers such as the wet lay-up of fiberglass laminate in a mold. All the layers of adhesive cure together in a single fused layer. Epoxy applied over partially cured epoxy will chemically link with it and is a primary bond. The ability to chemically link diminishes as the epoxy cures and it becomes a secondary bond.
Secondary bonding relies on the mechanical linking of an adhesive to a material or cured epoxy surface. The adhesive must "key" into pores or scratches in the surface-a microscopic version of a dovetail joint. Proper surface preparation provides a texture that will help lock the cured epoxy to the surface.

Clamping

Any method of clamping is suitable as long as the parts to be joined are held so that movement will not occur. Common methods include spring clamps, "C" clamps and adjustable bar clamps, heavy rubber bands cut from inner tubes, nylon-reinforced packaging tape, applying weights, and vacuum bagging. When placing clamps near epoxy-covered areas, cover clamp pads with duct tape, or use polyethylene sheeting or release fabric under the clamps so they don' t inadvertently bond to the surface. Staples, nails or drywall screws are often used where conventional clamps will not work. Any fasteners left in should be of a non-corroding alloy such as bronze. In some cases the thickened epoxy or gravity will hold parts in position without clamps.

Bonding with fillets

A fillet (fil' it) is a coveshaped application of thickened epoxy that bridges an inside corner joint. It is excellent for bonding parts because it increases the surface area of the bond and serves as a structural brace. All joints that will be covered with fiberglass cloth will require a fillet to support the cloth at the inside corner of the joint.

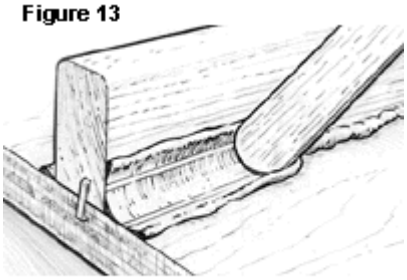
The procedure for bonding with fillets is the same as normal bonding except that instead of removing the squeezed-out thickened epoxy after the components are clamped in position, you shape it into a fillet. For larger fillets, add thickened mixture to the joint as soon as the bonding operation is complete, before the bonding mixture is fully cured, or any time after the final cure and sanding of exposed epoxy in the fillet area.

1. Bond parts as described in Bonding.

2. Shape and smooth the squeezed-out thick epoxy into a fillet by drawing a rounded filleting tool (mixing stick) along the joint, dragging excess material ahead of the tool and leaving a smooth cove-shaped fillet bordered on each side by a clean margin. Some excess filleting material will remain outside of the margin (Figure 13). Use the excess material to re-fill any voids. Smooth the fillet until you are satisfied with its appearance. A mixing stick will leave a fillet with about a 3/8" radius. For larger fillets, an 808 Plastic Squeegee, cut to shape or bent to the desired radius, works well.

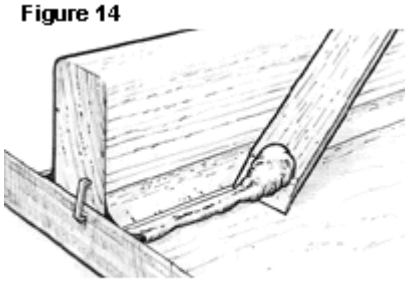
Apply additional thickened epoxy to fill voids or make larger fillets. Apply the mixture along the joint line with the rounded mixing stick, using enough mixture to create the desired size of fillet. For longer or multiple fillets, empty caulking gun cartridges or disposable cake decorating bags can be used. Cut the plastic tip to lay a bead of thickened epoxy large enough for the desired fillet size. Heavy duty, sealable food storage bags with one corner cut off may also be used.

Figure 13



Clean up the excess epoxy outside of the fillet margin.

Figure 14



Wet out a standard pilot hole and install the fastener.

3. Clean up the remaining excess material outside of the margin by using a sharpened mixing stick or a putty knife (Figure 14). Fiberglass cloth or tape may be applied over the fillet area before the fillet has cured (or after the fillet is cured and sanded).

4. Sand smooth with 80-grit sandpaper after the fillet has fully cured. Wipe the surface clean of any dust and apply several coats of resin/hardener over the entire fillet area before final finishing.

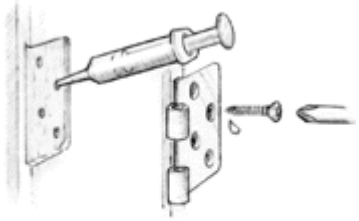
Bonding fasteners and hardware

Installing screws and other threaded fasteners with WEST SYSTEM epoxy dramatically improves load carrying capacity by spreading the fastener' s load into a greater area of the substrate. There are several methods or levels of hardware bonding depending on the loads on the hardware.

Basic fastener bonding

For improved pullout strength and waterproof connections, the easiest method is to simply wet out stripped fastener holes and new pilot holes before installing the screws. Epoxy penetrates the fiber around the hole, effectively increasing the fastener diameter. Epoxy also provides a stronger interface with the fastener threads than wood fiber and keeps out water.

Figure 15



Drill oversized holes to increase the exposed substrate area and the amount of epoxy around the fastener.

1. Wet out a standard-size pilot hole. Work the mixture well into the hole with a pipe cleaner or syringe (Figure 15). Thicken a second coat of epoxy as necessary for stripped or oversized holes.
2. Insert the fastener in the hole and allow the epoxy to cure.

Advanced fastener bonding

For greater strength and stability, drill oversized holes to increase the exposed substrate area and the amount of epoxy around the fastener. If the fastener/hardware can be clamped by other means, the oversized hole can be extended to the end of the fastener.

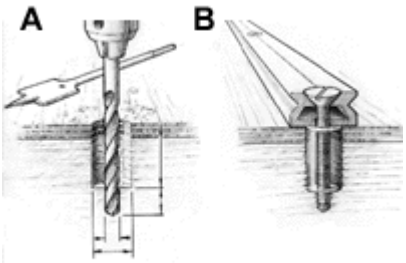


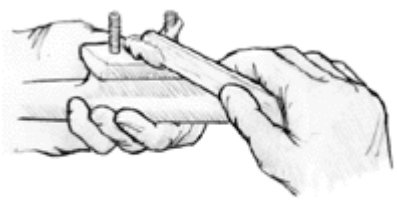
Figure 16 Shape and smooth the fillet with a rounded filleting tool.

1. Drill oversized holes 2/3-3/4 the depth of the fastener. The diameter may be up to twice the fastener diameter (Figure 16a).
2. Drill a normal sized pilot hole at the bottom of the oversized hole to the full length of the fastener. The normal sized pilot hole serves to hold or clamp the hardware in position until the epoxy cures.
3. Wet out the holes and the fastener with epoxy. Allow the epoxy to thoroughly soak into the exposed end grain of the wood.
4. Fill the hole with thickened epoxy/adhesive filler. Use 404 High-density (preferred) or 406 Colloidal Silica.
5. Install the fasteners with just enough force to hold the hardware in place. Allow the epoxy to cure thoroughly before applying load to the hardware (Figure 16b).

Bonding hardware

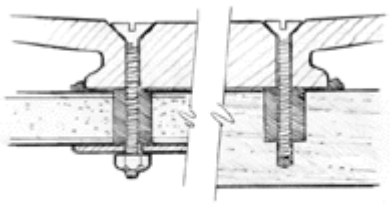
Bonding hardware goes a step beyond bonding the fasteners only. By bonding the hardware base directly to the surface you further increase hardware load capacity and provide a solid bearing surface for the hardware. It also seals the wood underneath, and is a stronger, longer lasting attachment than bonding the fasteners only. It is especially useful to mount hardware on curved, uneven or unlevel surfaces.

Figure 17



Coat the hardware bottom and the fastener threads with thickened epoxy.

Figure 18



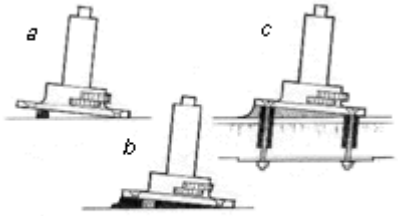
Tighten the fasteners until a small amount of epoxy squeezes from the joint.

1. Prepare the mounting surface and the hardware base for good adhesion.
2. Wet out the oversized hole with epoxy. Allow the epoxy to soak into the exposed end grain of the wood (as with faster bonding).
3. Coat the bottom contact surface of the hardware with unthickened epoxy. Wire brush or sand the wet epoxy into the surface with 50-grit sandpaper.
4. Inject a non-sagging epoxy/404 or 406 mixture into the hole. Use enough mixture so there are no voids in the hole after inserting the fastener. Coat the bottom of the hardware and the fastener threads with thickened epoxy (Figure 17).
5. Place the hardware in position. Insert and tighten fasteners until a small amount of the mixture squeezes out of the joint (Figure 18).
6. Remove excess epoxy or shape into a fillet. Allow the epoxy to cure at least 24 hours before applying load to the hardware. Allow more time in cool weather.

Casting a base

Use the thickened epoxy to cast a base under the hardware when mounting hardware to a curved or uneven surface, or mounting hardware at an angle to the surface.

Figure 19



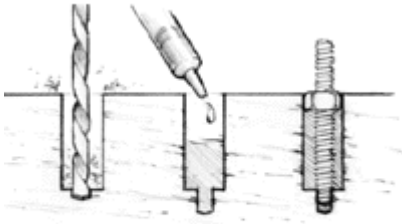
Support the base in position with blocking - apply enough thickened epoxy to fill void.

1. Prepare the fasteners, holes, substrate and base as described above.
2. Bond small blocks to the substrate to support the base at the desired height and position (e.g. winch base, Figure 19a)
3. Apply enough thickened epoxy to cover the blocks. If the gap between the base and the surface is over 1/2", fill the gap in two separate layers to avoid exotherm.
4. Place the hardware in position, resting on the blocks (Figure 19b) and install the fasteners.
5. Smooth the excess epoxy into the desired fillet shape around the base (Figure 19c). Allow the epoxy to cure fully before loading. Protect exposed epoxy from UV.

Bonding studs

Bond threaded rods or studs into the substrate (instead of bolts or screws) and attach the hardware with nuts. This variation is appropriate for many engine, motor or machine installations. Coat the base with wax /mold release to make the hardware removable. Although the hardware is not "bonded" to the substrate, the epoxy still provides a bearing surface that perfectly matches and supports the base of the hardware.

Figure 20



Bond threaded rods or studs into the substrate as an alternative for easily removable hardware.

1. Prepare the studs/threaded rods by waxing the upper ends (above the surface) and cleaning the lower ends (below the surface).
2. Place a nut and washer on the studs, wet out the lower ends and push them into the epoxy filled holes. Allow the epoxy to cure thoroughly before tightening the nuts (Figure 20).

Removing fasteners

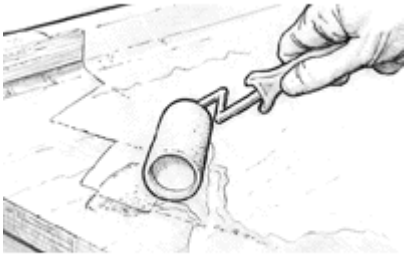
If you know that you will want to remove the fastener, you can coat the threads with wax or mold release (contaminating the surface enough to prevent a good bond).

Remove a permanently bonded fastener by applying heat to the head of the fastener with a soldering iron or propane torch. Use a heat shield to protect the surrounding area. Heat will travel down the fastener, softening the epoxy in contact with it. At about 120°F the epoxy should soften enough to allow the fastener to be backed out. Allow more time for heat to travel down longer or larger diameter fasteners.

Fairing

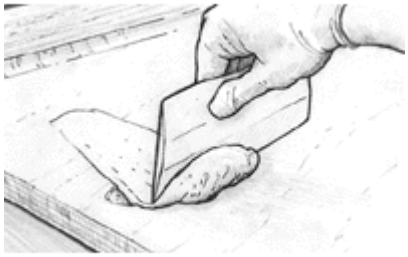
Fairing refers to the filling and shaping of low areas so they blend with the surrounding surfaces and appear "fair" to the eye and touch. After major structural assembly has been completed, final fairing can be easily accomplished with WEST SYSTEM epoxy and low-density fillers.

Figure 21



Wet out porous surfaces before applying fairing compound.

Figure 22

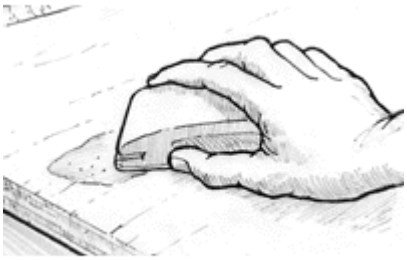


Apply fairing compound to fill all voids and smooth to shape.

1. Prepare the surface as you would for bonding. Sand smooth any bumps or ridges on the surface and remove all dust from the area to be faired.
2. Wet out porous surfaces with unthickened epoxy (Figure 21).

3. Mix resin/hardener and 407 Low-Density or 410 Microlight(TM) filler to a peanut butter consistency. The thicker the mixture, the easier it will be to sand when cured.
4. Trowel on the thickened epoxy mixture with a plastic squeegee, working it into all voids and depressions. Smooth the mixture to the desired shape, leaving the mixture slightly higher than the surrounding area (Figure 22). Remove any excess thickened epoxy before it cures. If the voids you are filling are over 1/2" deep, apply the mixture in several applications or use 206 Slow Hardener or 209 Tropical Hardener, depending on ambient temperature.
Note: On vertical and overhead surfaces, allow the wet-out coat to gel before applying fairing compound. The fairing compound may sag or slide off the fresh wet-out coat. Apply the fairing compound while the wet-out is still in the gel stage.

Figure 23



Sand cured fairing compound to desired contour.

5. Allow the final thickened epoxy application to cure thoroughly.
6. Sand the fairing material to blend with the surrounding contour (Figure 23). Begin with 50-grit sandpaper if you have a lot of fairing material to remove. Use 80-grit paper on the appropriate sanding block when you are close to the final contour. CAUTION! Don' t forget your dust mask. Remove the sanding dust and fill any remaining voids following the same procedure.
7. Apply several coats of resin/hardener to the area with a disposable brush or roller after you are satisfied with the fairness. Allow the final coat to cure thoroughly before final sanding and finishing.

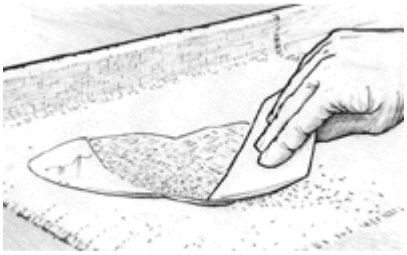
Applying woven cloth & tape

Fiberglass cloth is applied to surfaces to provide reinforcement and/or abrasion resistance, or in the case of Douglas Fir plywood, to prevent grain checking. It is usually applied after fairing and shaping are completed, and before the final coating operation. It is also applied in multiple layers (laminated) and in combination with other materials to build composite parts.
Fiberglass cloth may be applied to surfaces by either of two methods. The "dry" method refers to applying the cloth over a dry surface. The "wet" method refers to applying the cloth to an epoxy-coated surface often after the wet-out coat becomes tacky, which helps it cling to vertical or overhead surfaces. Since this method makes it more difficult to position the cloth, the dry method is the preferred method especially with thinner cloth.

Dry method

1. Prepare the surface as you would for bonding.
2. Position the cloth over the surface and cut it several inches larger on all sides. If the surface area you are covering is larger than the cloth size, allow multiple pieces to overlap by approximately two inches. On sloped or vertical surfaces, hold the cloth in place with masking or duct tape, or with staples.
3. Mix a small quantity of epoxy (three or four pumps each of resin and hardener).
4. Pour a small pool of resin/hardener near the center of the cloth.
5. Spread the epoxy over the cloth surface with a plastic spreader, working the epoxy gently from the pool into the dry areas (Figure 24). Use a foam roller or brush to wet out fabric on vertical surfaces. Properly wet out fabric is transparent. White areas indicate dry fabric. If you are applying the cloth over a porous surface, be sure to leave enough epoxy to be absorbed by both the cloth and the surface below it. Try to limit the amount of squeegeeing you do. The more you "work" the wet surface, the more minute air bubbles are placed in suspension in the epoxy. This is especially important if you plan to use a clear finish. You may use a roller or brush to apply epoxy to horizontal as well as vertical surfaces.
Smooth wrinkles and position the cloth as you work your way to the edges. Check for dry areas (especially over porous surfaces) and re-wet them as necessary before proceeding to the next step. If you have to cut a pleat or notch in the cloth to lay it flat on a compound curve or corner, make the cut with a pair of sharp scissors and overlap the edges for now.

Figure 24



Spread the epoxy over the cloth surface with a plastic spreader.

Figure 25

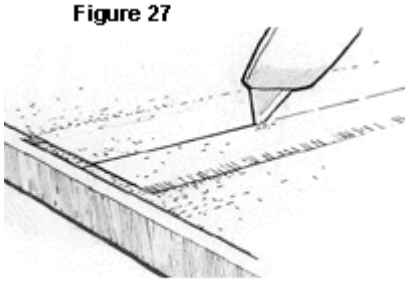
Squeegee away excess epoxy before it begins to gel.

6. Squeegee away excess epoxy before the first batch begins to gel (Figure 25). Slowly drag the squeegee over the fabric at a low, almost flat, angle, using even-pressured, overlapping strokes. Use enough pressure to remove excess epoxy that would allow the cloth to float off the surface, but not enough pressure to create dry spots. Excess epoxy appears as a shiny area, while a properly wet-out surface appears evenly transparent, with a smooth, cloth texture. Later coats of epoxy will fill the weave of the cloth.
7. Trim the excess (Figure 26) and overlapped cloth (Figure 27) after the epoxy has reached its initial cure. The cloth will cut easily with a sharp utility knife. Trim overlapped cloth, if desired, as follows:

Figure 26

Trim excess cloth after the epoxy gels.

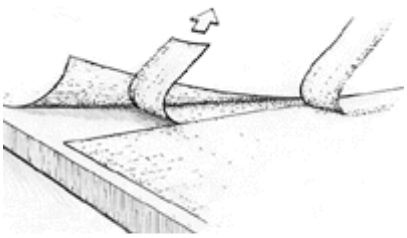
Figure 27



Trim overlapped cloth after the epoxy gels.

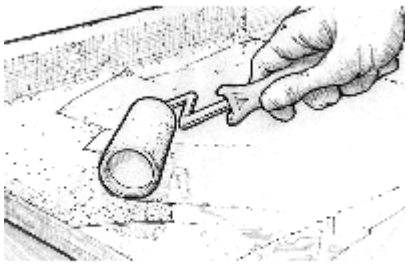
Place a metal straightedge on top of and midway between the two overlapped edges. b) Cut through both layers of cloth with a sharp utility knife. c) Remove the top-most trimming and then lift the opposite cut edge to remove the overlapped trimming (Figure 28). d) Re-wet the underside of the raised edge with epoxy and smooth into place.

Figure 28



Remove the top-most trimming, lift the opposite cut edge to remove the overlapped trimming.

Figure 29



Coat the surface to fill the weave before the wet-out reaches its final cure stage.

The result should be a near perfect butt joint, eliminating double cloth thickness. A lapped joint is stronger than a butt joint, so if appearance is not important, you may want to leave the overlap and fair in the unevenness after coating.

8. Coat the surface to fill the weave before the wet-out reaches its final cure stage (Figure 29).

Follow the procedures for final coating in the next section. It will take two or three coats to completely fill the weave of the cloth and to allow for a final sanding that will not affect the cloth.

Wet method

An alternative is to apply the fabric or tape to a surface coated with wet epoxy. As mentioned, this is not the preferred method, especially with large pieces of cloth, because of the difficulty removing wrinkles or adjusting the position of the cloth as it is being wet out. However, you may come across situations when this method may be useful or necessary.

1. **Prepare the surface** for bonding. Pre-fit and trim the cloth to size. Roll the cloth neatly so that it may be conveniently rolled back into position later.
2. Roll a heavy coat of epoxy on the surface.

3. Unroll the glass cloth over the wet epoxy and position it. Surface tension will hold most cloth in position. If you are applying the cloth vertically or overhead, you may want to thicken the epoxy slightly with filler, then wait until it becomes sticky. Work out wrinkles by lifting the edge of the cloth and smoothing from the center with your gloved hand or a squeegee.
4. Apply a second coat of epoxy with a foam roller. Apply enough epoxy to thoroughly wet out the cloth.
5. Remove the excess epoxy with a squeegee, using long overlapping strokes. The cloth should appear consistently transparent with a smooth cloth texture.
6. Follow steps 7, 8 and 9 under the dry method to finish the procedure.

Any remaining irregularities or transitions between cloth and substrate can be faired by using an epoxy/filler fairing compound if the surface is to be painted. Any additional fairing done after the final coating should receive several additional coats over the faired area.

Note: A third alternative for more experienced users is a variation of both methods. Apply the fabric after a wet out coat has reached an initial cure. Follow the first three steps of the Wet Method, but wait until the epoxy cures dry to the touch before positioning the fabric and continuing with Step 3 of the Dry Method. Apply the fabric before the first coat reaches its final cure phase.

NOTE: Clear Wood Finishes

(stripper canoes, etc.) An alternative wet out method is to lay the epoxy onto the fabric with a short-bristled bush. Dip the brush in the epoxy and lay the epoxy on the surface with a light even stroke. Don' t force the epoxy into the cloth, which may trap air in the fabric and show through the clear finish. Apply enough epoxy to saturate the fabric and the wood below. After several minutes, lay on additional epoxy to dry (white) areas. If epoxy appears milky due to high humidity or over-working, warm the surface by passing a heat gun or hair dryer over the surface. Use low heat to avoid out-gassing. Be sure to use 207 Hardener for clear finishes.

Epoxy barrier coating

The object of barrier coating is to build up an epoxy coating that provides an effective moisture barrier and a smooth base for final finishing.

Apply a minimum of two coats of WEST SYSTEM epoxy for an effective moisture barrier. Apply three coats if sanding is to be done. Moisture protection will increase with additional coats, up to six coats or about a 20-mil thickness. Additives or pigments should not be added to the first coat. Mixing thinners with WEST SYSTEM epoxy is not recommended.

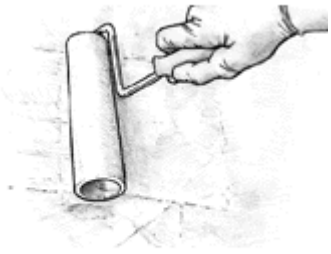
Disposable, thin urethane foam rollers, such as WEST SYSTEM 800 Roller Covers, allow you greater control over film thickness, are less likely to cause the epoxy to exotherm and leave less stipple than thicker roller covers. Cut the covers into narrower widths to reach difficult areas or for long narrow surfaces like stringers.

Complete all fairing and cloth application before beginning the final coating. Allow the temperature of porous surfaces to stabilize before coating. Otherwise,

as the material warms up, air within the porous material may expand and pass from the material (out-gassing) through the coating and leave bubbles in the cured coating.

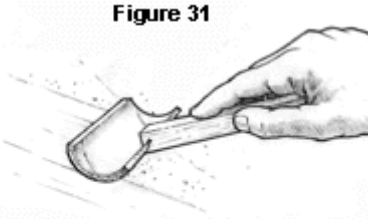
1. Prepare the surface for.
2. Mix only as much resin/hardener as you can apply during the open time of the mixture. Pour the mixture into a roller pan as soon as it is mixed thoroughly.
3. Load the roller with a moderate amount of the epoxy mixture. Roll the excess out on the ramp part of the roller pan to get a uniform coating on the roller.
4. Roll lightly and randomly over an area approximately 2 ft x 2 ft to transfer the epoxy evenly over the area (Figure 30).
5. As the roller dries out, increase pressure enough to spread the epoxy into a thin even film. Increase the coverage area if necessary to spread the film more thinly and evenly. The thinner the film, the easier it is to keep it even and avoid runs or sags in each coat.
6. Finish the area with long, light, even strokes to reduce roller marks. Overlap the previously coated area to blend both areas together.
7. Coat as many of these small working areas as you can with each batch. If a batch begins to thicken before it can be applied, discard it and mix a fresh, smaller batch.

Figure 30



Roll lightly and randomly over a small area. Spread the epoxy into thin even film .

Figure 31



Tip off the coating b dragging a foam roller brush lightly over the fresh epoxy.

8. Tip off the coating by dragging a foam roller brush lightly over the fresh epoxy in long, even, overlapping strokes after each batch is applied. Use enough pressure to smooth the stipple, but not enough to remove any of the coating (Figure 31). Alternate the direction in which each coat is tipped off, 1st coat vertical, 2nd coat horizontal, 3rd coat vertical, etc. A WEST SYSTEM 800 Roller Cover can be cut into segments to make a tipping brush.

Recoating

Apply second and subsequent coats of epoxy following the same procedures. Make sure the previous coat has cured firmly enough to support the weight of the next coat. To avoid sanding between coats, apply all of the coats in the same day. See Special preparation-Cured epoxy. After the final coat has cured overnight, wash and sand it to prepare for the final finish.

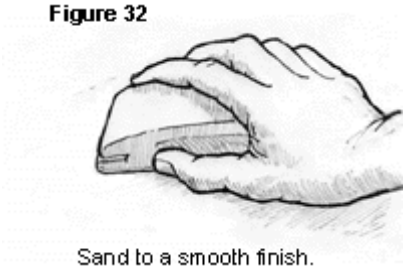
Final surface preparation

Proper finishing techniques will not only add beauty to your efforts, but will also protect your work from ultraviolet light, which will break down epoxy over time.

The most common methods of finishing are painting or varnishing. These coating systems protect the epoxy from ultraviolet light and require proper preparation of the surface before application.

Preparation for the final finish is just as important as it is for recoating with epoxy. The surface must first be clean, dry and sanded.

Figure 32



Sand to a smooth finish.

1. Allow the final epoxy coat to cure thoroughly.
2. Wash the surface with a Scotch-brite(TM) pad and water to remove amine blush. Dry with paper towels.
3. Sand to a smooth finish (Figure 32). If there are runs or sags, begin sanding with 80-grit paper to remove the highest areas. Sand until the surface feels and looks fair. Complete sanding with the appropriate grit for the type of coating to be applied-check coating instructions. Paint adhesion relies on the mechanical grip of the paint keying into the sanding scratches in the epoxy' s surface. If a high-build or filling primer is to be applied, 80-100 grit is usually sufficient. 120-180 grit may be adequate for primers and high-solids coatings. Finishing with 220-400 grit paper will result in a high-gloss finish for most paints or varnishes. Grits finer than this may not provide enough tooth for good adhesion. Many people prefer wet sanding because it reduces sanding dust and it will allow you to skip Step 2.
4. After you are satisfied with the texture and fairness of the surface, rinse the surface with fresh water. Rinse water should sheet evenly without beading or fisheyeing. If rinse water beads up (a sign of contamination), wipe the area with solvent and dry with a paper towel, then wet sand again until beading is eliminated.

Proceed with your final coating after the surface has dried thoroughly. To reduce the possibility of contamination, it is a good idea to begin coating within 24 hours of the final sanding. Follow all of the instructions from the coating system' s manufacturer. A good trick used by professionals, is to make a test panel to evaluate the degree of surface preparation required and the compatibility of the finish system.

Finish coatings

The function of a finish coating like paint or varnish over an epoxy barrier coat, is to decorate the surface and protect the epoxy from sunlight. In doing so, the finish coating extends the life of the epoxy moisture barrier, which, in turn provides a stable base that extends the life of the finish coating. Together the two form a protective system far more durable than either coating by itself. Protection from sunlight is a primary consideration in the selection of a finish coating. Long term UV (ultraviolet) protection of the barrier coat depends on

how well the finish coating itself resists UV and keeps its pigments, or its shield of UV filters on the surface of the epoxy barrier coat. A high gloss finish reflects a higher proportion of the light hitting the surface than a dull surface. All other thing being equal, a white (especially a glossy white) coating will last the longest.

Most types of coatings are compatible with epoxy. Thoroughly cured epoxy is an almost completely inert hard plastic. This means most paint solvents will not soften, swell or react with it. However, it is still a good idea to build a test panel to assure coating compatibility.

Coating types

Latex paints are compatible with epoxy and they do an adequate job of protecting the epoxy barrier from UV radiation. In many architectural applications latex paint may be the most suitable coating to use. Their durability is limited.

Alkyd finishes-enamel, alkyd enamel, marine enamel, acrylic enamel, alkyd modified epoxy, traditional varnish and spar varnish-offer ease of application, low cost, low toxicity, and easy availability. Their disadvantages are low UV resistance and low abrasion resistance.

One-part polyurethanes offer easy application, cleanup and better properties than alkyds. They are also more expensive and some may be incompatible with amine cure epoxy systems such as WEST SYSTEM epoxy, although 207 Hardener may offer better compatibility. Test first.

Epoxy paints are available in one-part and two-part versions. Two-part epoxies offer many characteristics similar to the higher performance polyurethanes. They are durable and chemical resistant, but offer limited UV protection compared to the linear polyurethanes.

Two-part linear polyurethane (LP) paints offer the most durable protection available. LP' s are available as pigmented or clear coatings and offer excellent UV protection, gloss retention, abrasion resistance, plus compatibility with epoxy. However, compared to other types of coatings, they are expensive, require more skill to apply and present a greater health hazard, especially when sprayed.

Bottom paints are available in a variety of formulations. Most bottom paint systems are compatible with epoxy and can be applied directly over a prepared epoxy barrier coat. If you are unsure of compatibility or have curing or adhesion problems with a specific bottom paint, use only a primer recommended for that bottom paint over the barrier coat. Follow the recommendations given for preparation of fiberglass surfaces. Other paints, including marine LP' s and primers, are not recommended for use below the waterline.

Primers are usually not needed to help a paint film bond to epoxy, although interfacing primers may be required with some specialized bottom paints and high-build primers are useful for hiding scratches or flaws in the substrate. If the instructions on your paint or varnish recommend a specially primed surface, follow the recommendations given for fiberglass preparation. Self-etching primers do not work well on an epoxy coating because of epoxy' s chemical

resistance.

Polyester gelcoat is a pigmented version of the resin used to build fiberglass boats and other products. Gelcoat is sprayed into a mold before the glass fabric and resin are applied to provide a smooth pre-finished surface when the part is removed from the mold. It is not often used as a post-production finish coating, but it can be applied over epoxy and is useful in some repair situations. Refer to *002-550 Fiberglass Boat Repair and Maintenance*, published by Gougeon Brothers, for detailed information on patching gelcoat over an epoxy repair.

Follow all instructions from the coating systems manufacturer. It is a good idea to make a test panel to evaluate the degree of surface preparation required, and the compatibility and handling characteristics of the finish system.

For detailed instruction on the application of these techniques in repair and construction, refer to specific WEST SYSTEM instructional publications and videos. For complete descriptions of all WEST SYSTEM products, including selection and coverage guides, go to the **Product Guide**.

To help you identify and prevent potential problems associated with using epoxy, go to the Problem Solver.

For complete information on the hazards associated with epoxy and the precautions you can take to avoid them, go to Health & Safety.

To see how these techniques have been put to use in a wide range of repair and construction applications go to the Projects pages.

Tips

Thinning epoxy

There are epoxy-based products specifically designed to penetrate and reinforce rotted wood. These products, basically an epoxy thinned with solvents, do a good job of penetrating wood. But the solvents compromise the strength and moisture barrier properties of the epoxy. WEST SYSTEM epoxy can be thinned with solvents for greater penetration, but not without the same compromise in strength and moisture resistance. Acetone, toluene or MEK have been used to thin WEST SYSTEM epoxy and duplicate these penetrating epoxies with about the same effectiveness. If you chose to thin the epoxy, keep in mind that the strength and moisture protection of the epoxy are lost in proportion to the amount of solvent added.

There is a better solution to get good penetration without losing strength or moisture resistance. We recommend moderate heating of the repair area and the epoxy with a heat gun or heat lamp. The epoxy will have a lower viscosity and penetrate more deeply when it is warmed and contacts the warmed wood cavities and pores. Although the working life of the epoxy will be considerable shortened, slower hardeners (206, 207, 209) will have a longer working life and should penetrate more than 205 Hardener before they begin to gel. When the epoxy cures it will retain all of its strength and effectiveness as a moisture barrier, which we feel more than offsets any advantages gained by adding solvents to the epoxy.

Removing epoxy

Removing uncured or non-curing epoxy. Uncured epoxy is removed as you would spilled resin. Scrape as much material as you can from the surface using a stiff metal or plastic scraper—warm the epoxy to lower its viscosity. Clean the residue with lacquer thinner, acetone, or alcohol. Follow safety warnings on solvents, and provide adequate ventilation. After recoating wood surfaces with epoxy, it' s a good idea to brush the wet epoxy (in the direction of the grain) with a wire brush to improve adhesion. Allow solvents to dry before recoating.

Removing fiberglass cloth applied with epoxy.

Use a heat gun to heat and soften the epoxy. Start in a small area a near a corner or edge. Apply heat until you can slip a putty knife or chisel under the cloth (about 200°F). Grab the edge with a pair of pliers and pull up on the cloth while heating just ahead of the separation. On large areas, use a utility knife to score the glass and remove in narrower strips. Resulting surface texture may be coated or remaining epoxy may be removed as follows.

Removing cured epoxy coating.

Use a heat gun to soften the epoxy (200°F). Heat a small area and use a paint or cabinet scraper to remove the bulk of the coating. Sand the surface to remove the remaining material. Provide ventilation when heating epoxy.

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